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**Estimates of Dose Due to  
Noble Gas Releases from the  
Three Mile Island Incident  
Using the AIRDOS-EPA  
Computer Code**

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## ABSTRACT

In response to a request from the Task Group on Health Physics and Dosimetry of the President's Commission on the Accident at Three Mile Island (TMI), radiation doses to persons living within 80 km were estimated using the AIRDOS-EPA computer code.

Hourly radionuclide release and corresponding meteorological data were supplied by the Task Group. From these data the degree of dispersion of the total release into each of 16 wind direction sectors was calculated. The average fractions of the total release of the noble gases  $^{133}\text{Xe}$ ,  $^{135}\text{Xe}$ , and  $^{88}\text{Kr}$  (the major dose contributors) were estimated to be 95%, 4%, and 1%, respectively. The release period used in our calculations was from March 28 through April 15, 1979 (19 days).

Our original population dose estimate to the total body of 4 person-Sv was based on a  $22.5^\circ$  sector-averaged Gaussian plume atmospheric dispersion model calculation assuming an elevated release. This dose estimate is about a factor of 7 lower than the dose estimated by the Task Group (neglecting shielding effects) based on 20 thermoluminescent dosimeter (TLD) measurements (28 person-Sv). Comparison of predictions by our model with the individual TLD measurements revealed that use of a ground-level release resulted in better agreement with the TLDs than did use of an elevated release. Assuming a ground-level release, our revised population dose was 15 person-Sv, which is within a factor of 2 of the Task Group estimate.

The highest population dose estimate for the TMI incident is about 1% of that expected annually from natural background for the same population (2700 person-Sv). It has been estimated that this dose is too small to result in any detectable physical health impact.

## INTRODUCTION

Beginning on March 28, 1979, a sequence of events occurred at the Three Mile Island (TMI) Unit 2 nuclear power reactor near Harrisburg, Pennsylvania, which resulted in the accidental release of an amount of radioactive gases to the atmosphere in excess of that emitted during routine reactor operations. A comprehensive study of this incident has been prepared by the President's Commission on the Accident at Three Mile Island (Kemeny, 1979). As part of this study, the Task Group on Health Physics and Dosimetry (TGHPD) requested the authors to estimate the dose to the population within 80 km (50 miles) of the reactor for the period March 28 through April 15, 1979. Subsequent to these calculations, dosimetric monitoring data from around the plant were examined and adjustments were made in the population dose calculations. The purpose of this report is to present our best estimate of the population dose from the TMI incident and to discuss the methodology used in making the calculation.

## METHODS

### AIRDOS-EPA

The AIRDOS-EPA computer code (Moore et al., 1979) was used to estimate the dose to the population within 80 km of the TMI plant. This code calculates downwind air concentrations using a constant mean wind velocity Gaussian plume atmospheric dispersion model (Pasquill, 1961). The equation used by AIRDOS-EPA to calculate the concentration of an airborne plume as it is blown downwind from a stack is

$$x = \frac{Q}{2\pi\sigma_y(x)\sigma_z(x)u} \exp \left[ -\frac{1}{2} \left( \frac{y}{\sigma_y(x)} \right)^2 \right] \left\{ \exp \left[ -\frac{1}{2} \left( \frac{z - H}{\sigma_z(x)} \right)^2 \right] + \exp \left[ -\frac{1}{2} \left( \frac{z + H}{\sigma_z(x)} \right)^2 \right] \right\}, \quad (1)$$

where

$x$  = concentration in air at  $x$  meters downwind,  $y$  meters cross-wind, and  $z$  meters above ground ( $\text{Bq}/\text{m}^3$ ),

$Q$  = uniform emission rate from the stack ( $\text{Bq}/\text{sec}$ ),

$\bar{u}$  = mean wind speed ( $\text{m/sec}$ ),

$\sigma_y(x)$  = horizontal dispersion coefficient ( $\text{m}$ ),

$\sigma_z(x)$  = vertical dispersion coefficient ( $\text{m}$ ),

$H$  = effective stack height (physical stack height,  $h$ , plus the plume rise,  $\Delta h$ ) ( $\text{m}$ ).

For long-term releases and population exposure estimates, a form of the Gaussian plume model averaged in the crosswind ( $y$ ) direction is often used. The  $22.5^\circ$  sector-averaged form of the model with  $Z = 0$  (air concentrations at ground-level) is given by

$$x = \frac{Q}{0.16 \pi \times \sigma_z \bar{u}} \exp \left[ -1/2 \left( \frac{H}{\sigma_z} \right)^2 \right] . \quad (2)$$

Both Eqs. (1) (with  $z = 0$ ) and (2) were utilized in these TMI calculations.

The air concentrations calculated using Eq. (1) or Eq. (2) were used to estimate doses. The dose due to immersion in air is given by

$$D_{imm} = x C_{imm} (1 \times 10^{-6}) , \quad (3)$$

where

$x$  = ground-level air concentration ( $\text{Bq}/\text{m}^3$ ),

$D_{imm}$  = air immersion dose ( $\text{Sv}$ ),

$C_{imm}$  = dose conversion factor for immersion in air ( $\text{Sv/year}$  per  $\text{Bq}/\text{cm}^3$ ),

$1 \times 10^{-6}$  = units conversion factor.

Doses due to inhalation were calculated using the relationship

$$D_{inh} = x B_r C_{inh} , \quad (4)$$

where

$D_{inh}$  = inhalation dose (Sv/year),

$x$  = ground-level air concentration (Bq/m<sup>3</sup>),

$B_r$  = breathing rate (m<sup>3</sup>/year),

$C_{inh}$  = dose conversion factor for inhalation (Sv/Bq).

Both air immersion and inhalation doses were estimated for total body, red bone marrow, lungs, endosteal cells, stomach wall, lower large intestine wall, thyroid, liver, kidneys, testes, and ovaries.

The AIRDOS-EPA computer code also has the capability of estimating wet and dry deposition effects and the resulting doses from surface exposure and ingestion. Such calculations were not made for this study, however, since the only radionuclides considered were nonreactive noble gases.

#### Meteorological Data

Meteorological data taken at the TMI tower were obtained from the staff of the TGHPD. These data were adjusted for use as input in the AIRDOS-EPA calculations (Appendix A). Hourly values of wind direction, wind speed, and the vertical temperature gradient for the time period being considered were used. The temperature data were used to derive hourly values of the Pasquill atmospheric stability categories using the criteria shown in Table 1 (USNRC, 1972). A joint frequency distribution of the average wind speed for each of 16 wind direction sectors and 7 stability classes was constructed. The wind direction sectors used are defined in Table 2. These data were analyzed using the SAS 76 computer system (Barr et al., 1976).

Mixing height values for the period of the TMI release were not supplied by the TGHPD staff. Instead, mean values of the mixing height

Table 1. Classification of Pasquill atmospheric stability categories

Stability classification	Pasquill categories	Temperature change with height ( $^{\circ}\text{C}/100 \text{ m}$ )	Temperature change with height ( $^{\circ}\text{F}/117 \text{ ft}$ ) <sup>a</sup>
Extremely unstable	A	<-1.9	<-1.22
Moderately unstable	B	-1.9 to -1.7	-1.22 to -1.09
Slightly unstable	C	-1.7 to -1.5	-1.09 to -0.96
Neutral	D	-1.5 to -0.5	-0.96 to -0.32
Slightly stable	E	-0.5 to 1.5	-0.32 to 0.96
Moderately stable	F	1.5 to 4.0	0.96 to 2.57
Extremely stable	G	>4.0	>2.57

<sup>a</sup>Temperature gradients measured at TMI were between 33 ft and 150 ft.

Table 2. Wind direction "toward" categorized into 22.5° sectors of a circle

Wind direction "toward"	Sector	Degrees of circle defining sector
N	1	<11.25°, $\geq$ 348.75°
NNW	2	<348.75°, $\geq$ 326.25°
NW	3	<326.25°, $\geq$ 303.75°
WNW	4	<303.75°, $\geq$ 281.25°
W	5	<281.25°, $\geq$ 258.75°
WSW	6	<258.75°, $\geq$ 236.25°
SW	7	<236.25°, $\geq$ 213.75°
SSW	8	<213.75°, $\geq$ 191.25°
S	9	<191.25°, $\geq$ 168.75°
SSE	10	<168.75°, $\geq$ 146.25°
SE	11	<146.25°, $\geq$ 123.75°
ESE	12	<123.75°, $\geq$ 101.25°
E	13	<101.25°, $\geq$ 78.75°
ENE	14	<78.75°, $\geq$ 56.25°
NE	15	<56.25°, $\geq$ 33.75°
NNE	16	<33.75°, $\geq$ 11.25°

for January and June were obtained (Slade, 1968) and averaged. The resulting value of 900 m was used in the AIRDOS-EPA calculations.

#### Source Term

Radionuclides from the TMI incident were emitted via a vent stack located atop the auxiliary building adjacent to the unit 2 containment building (Fig. 1). The stack is 55 m above ground level but only 6 m above the auxiliary building roof and 3 m above the closest obstruction. The stack is 1.2 m in diameter, and the effluent had an exit velocity of 36 m/sec. In some of our calculations this exit velocity was used to estimate a momentum plume rise as given by

$$\Delta h = 1.5 \frac{vd}{u} , \quad (5)$$

where

$\Delta h$  = plume rise (m),

$v$  = effluent stack gas velocity (m/sec),

$d$  = inside diameter of stack (m),

$u$  = mean wind speed (m/sec).

Since the temperature of the TMI effluent was assumed to be near ambient (Berger, 1979), no additional plume rise due to buoyancy was considered in this study.

A direct measurement of stack effluents during the TMI incident was not performed, and thus, the amount and identity of the aerosols released are unknown. The total release of radionuclides used in these calculations was inferred from the response of a stationary gamma radiation monitor located external to the base of the stack. Release rate estimates (Bq/min) for various time periods during the incident were supplied to the authors by the TGHPD staff (Appendix B). From this information, hourly release rates (Bq/hr) were generated assuming a linear change in the release rate between the data points supplied. These release rates are listed in Appendix A with the TMI meteorological data.

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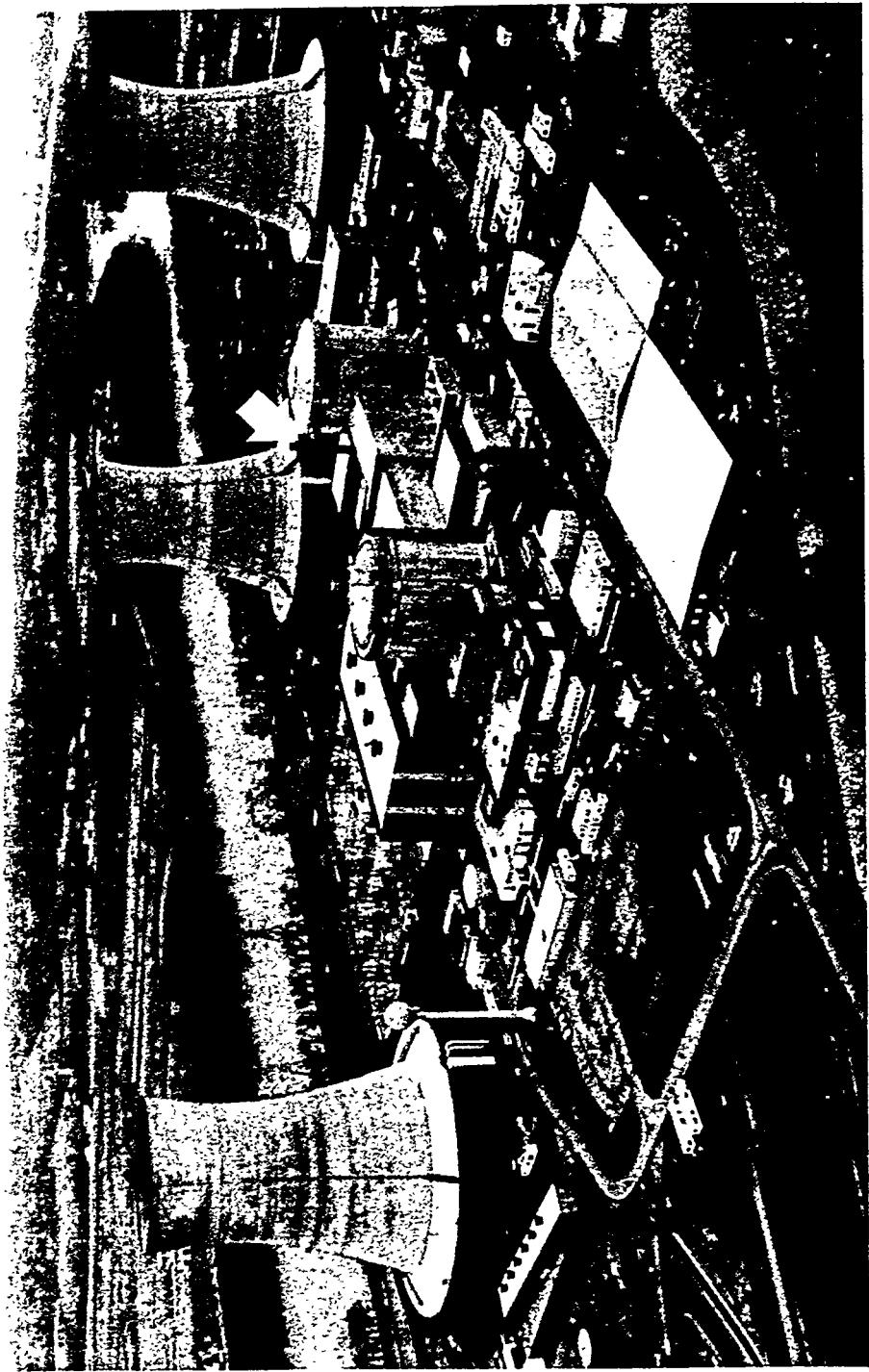


Fig. 1. Three Mile Island Nuclear Station, Unit 2 showing vent stack from which noble gases were released.

The total radionuclide release for this analysis of  $8.9 \times 10^{16}$  Bq ( $2.4 \times 10^6$  Ci) over the first 19 days after reactor shutdown was assumed for purposes of dose calculation to consist only of the three noble gases  $^{133}\text{Xe}$ ,  $^{135}\text{Xe}$ , and  $^{88}\text{Kr}$ . Other gases in the core inventory at the time of shutdown decayed out rapidly during the first few hours, and made insignificant contributions to dose. The composition of the gas mixture as a function of time during release was calculated using estimated quantities of the radionuclides in the core at shutdown (Berger, 1979) and their half-lives (Table 3).

Essentially all of the  $^{88}\text{Kr}$  was calculated to have decayed out of the gas mixture during the first 24 hr. Based on total release estimates as a function of time, the amount of  $^{88}\text{Kr}$  released during this 24-hr period was about 1% of the total radionuclides released during the entire 19-day period. About 4% of the total 19-day release consisted of  $^{135}\text{Xe}$ . The remainder of the total release (95%) was assumed to consist of the longer-lived  $^{133}\text{Xe}$ .

The total release was distributed among the 16 wind direction sectors by assigning each estimated hourly release to the wind direction sector reported for that hour. The resulting release into each sector was apportioned among the three radionuclides considered as noted above and then dispersed using Eq. (1) or Eq. (2).

#### Population

The projected 1980 population distribution within 80 km of the TMI site, adjusted for the actual 1979 population out to 3.2 km, was also supplied by the TGHPD staff. This distribution broken down by sector and distance for use in AIRDOS-EPA is reported in Tables 4 and 5. To calculate a population dose using AIRDOS-EPA, the air concentration and subsequent individual dose is calculated using Eq. (2) at downwind distances at the center of each annular ring in each wind direction sector. This dose is then assumed to be received by each individual at that distance and direction. The resulting population dose for each sector and annular ring is the product of the individual dose and total population for that area.

Table 3. Physical characteristics<sup>a</sup> of nuclides  
considered in calculations

Radionuclide	Half-life	Principal radiations, energy, MeV
<sup>133</sup> Xe	5.245 d	$\beta^-$ 0.346 max $\gamma$ 0.081 (37%)
<sup>135</sup> Xe	9.083 hr	$\beta^-$ 0.908 max $\gamma$ 0.25 (89.9%) 0.608 (2.89%)
<sup>88</sup> Kr	2.84 hr	$\beta^-$ 2.91 max $\gamma$ 2.39 (35%) 0.196 (26.3%) 2.2 (13.3%) 0.835 (13.1%) 1.53 (11.1%)

<sup>a</sup>Kocher, 1977.

Table 4. Projected 1980 population distribution, 0-10 miles -  
Three Mile Island Nuclear Station, Unit 2

Sector	Wind direction	Distance (miles)					
		0-1	1-2	2-3	3-4	4-5	5-10
1	N	19	212	3,970	3,772	415	11,840
2	NNW	1	1	1,240	942	1,921	16,632
3	NW	1	1	64	41	1,177	29,482
4	WNW	1	106	253	197	235	11,823
5	W	1	369	36	331	571	7,155
6	WSW	1	273	117	796	237	2,961
7	SW	1	104	181	562	219	4,297
8	SSW	1	98	584	217	752	6,883
9	S	1	1	136	817	1,317	12,190
10	SSE	88	197	117	78	43	3,840
11	SE	6	94	67	203	395	2,095
12	ESE	6	36	149	214	236	2,809
13	E	42	60	39	137	552	10,431
14	ENE	58	55	186	461	262	1,567
15	NE	42	134	271	428	186	2,246
16	NNE	55	75	169	480	373	11,223
Total		324	1,816	7,579	9,676	8,891	137,474

Table 5. Projected 1980 population distribution, 10-50 miles –  
Three Mile Island Nuclear Station, Unit 2

Sector	Wind direction	Distance (miles)				
		10-20	20-30	30-40	40-50	Total (0-50)
1	N	12,663	9,005	8,941	47,588	98,425
2	NNW	26,482	10,517	7,256	12,866	77,858
3	NW	99,593	9,308	9,970	12,630	162,267
4	WNW	70,460	14,188	5,333	3,681	106,277
5	W	21,769	35,025	10,370	20,602	96,229
6	WSW	5,882	7,996	8,948	23,010	50,221
7	SW	11,801	19,931	25,536	18,979	81,611
8	SSW	31,917	44,031	18,596	37,729	140,808
9	S	111,002	14,648	13,477	75,781	229,370
10	SSE	44,204	10,774	15,097	66,763	141,201
11	SE	20,152	10,000	10,600	26,958	70,570
12	ESE	34,339	124,988	27,822	42,737	233,336
13	E	18,853	62,028	42,445	38,754	173,341
14	ENE	10,205	14,757	45,445	177,672	250,668
15	NE	39,726	38,979	9,546	62,345	153,903
16	NNE	18,240	6,826	14,478	45,115	97,034
<b>Total</b>		577,288	433,001	273,860	713,210	2,163,119

## RESULTS

### Initial Calculations

Population dose estimates were prepared for the TGHPD staff by assuming that the plume remained elevated during release. Plume rise due to the momentum of the emissions was taken into account. The dose-rate conversion factors used in these calculations are shown in Tables 6 and 7. The resulting total-body population dose by sector is shown in Table 8. At least 96% of the total dose to all organs was from immersion in contaminated air. While  $^{88}\text{Kr}$  composed only 1% of the total release, its comparatively large dose-rate conversion factor for immersion in contaminated air resulted in  $^{88}\text{Kr}$  contributing up to 26% of the population dose in a given sector. The total population dose of approximately 4 person-Sv (395 person-rem) is about a factor of 7 less than the 28 person-Sv estimated from extrapolation of limited thermoluminescent dosimeter (TLD) measurements taken at the time of the incident (Berger, 1979). Both estimated doses neglect shielding effects due to building occupancy.

### Comparison of Observed and Predicted Doses

It is apparent from Fig. 1 that the release point for the noble gases considered in this study is surrounded by buildings and other structures. As a result, downdrafts could at times have brought all or part of the TMI plume to ground level. Methods are available for estimating the effects of such downdrafts and building wakes on downwind air concentrations (USNRC, 1977; Huber, 1979). However, no such methods are available in AIRDOS-EPA.

It can be seen from Eq. (3) that the air immersion dose as calculated by AIRDOS-EPA is directly proportional to the ground level air concentration. However, an external air immersion dose may also be delivered from a finite plume passing overhead when the ground level air concentration is very small, or even zero. While methods have been developed for estimating gamma doses from finite clouds (Slade, 1968; USNRC, 1977), these methods generally require too much computer time

Table 6. Dose-rate conversion factors<sup>a</sup> for external exposure from submersion in contaminated air

Organ	Dose-rate conversion factors (milli Sv/year per Bq/cm <sup>3</sup> )		
	<sup>133</sup> Xe	<sup>135</sup> Xe	<sup>88</sup> Kr
Total body	5.13E1 <sup>b</sup>	3.08E2	3.19E3
Stomach wall	3.08E1	2.81E2	2.73E3
Lower large intestine wall	2.17E1	2.28E2	2.62E3
Lungs	3.89E1	3.43E2	3.02E3
Kidneys	3.43E1	2.92E2	2.47E3
Liver	3.32E1	3.02E2	2.84E3
Ovaries	2.31E1	1.85E2	3.08E3
Red marrow	8.32E1	5.02E2	3.02E3
Endosteal cells	1.03E2	5.70E2	3.46E3
Testes	5.00E1	4.70E2	1.97E3
Thyroid	5.86E1	3.48E2	3.24E3

<sup>a</sup>Kocher, 1979.

<sup>b</sup>Read as 5.13 x 10<sup>1</sup>.

Table 7. Dose conversion factors<sup>a</sup> for inhalation of contaminated air

Organ	Dose-rate conversion factors (Sv/Bq)		
	<sup>133</sup> Xe	<sup>135</sup> Xe	<sup>88</sup> Kr
Total body	3.81E-15 <sup>b</sup>	5.78E-15	1.32E-14
Stomach wall	5.99E-16	2.65E-15	4.97E-15
Lower large intestine wall	7.40E-18	1.88E-16	8.42E-17
Lungs	2.30E-13	5.40E-13	8.18E-13
Kidneys	1.90E-16	2.50E-15	1.29E-15
Liver	8.83E-16	5.75E-15	2.78E-15
Ovaries	1.42E-17	3.67E-16	5.51E-16
Red marrow	8.37E-16	3.08E-15	2.07E-15
Endosteal cells	6.86E-16	2.45E-15	1.84E-15
Testes	6.99E-19	5.99E-17	4.56E-16
Thyroid	1.85E-16	2.92E-15	1.33E-15

<sup>a</sup>Derived from Bernard and Snyder (1975).<sup>b</sup>Read as  $3.81 \times 10^{-15}$ .

Table 8. Summary of estimated population doses to total body  
by sector resulting from the incident at Three Mile Island  
(March 28-April 15, 1979)

Compass direction $\alpha$	Sector	Number of persons	Population dose (person-Sv)	
			Elevated release	Ground-level release
N	1	98,425	0.35	2.45
NNW	2	77,858	1.12	1.94
NW	3	162,267	0.63	2.83
WNW	4	106,277	0.53	1.54
W	5	96,229	0.22	0.64
WSW	6	50,221	0.03	0.16
SW	7	81,611	0.05	0.14
SSW	8	140,808	0.07	0.47
S	9	229,370	0.10	0.34
SSE	10	141,201	0.12	0.36
SE	11	70,570	0.04	0.10
ESE	12	233,336	0.06	0.16
E	13	173,341	0.06	0.28
ENE	14	250,668	0.10	0.46
NE	15	153,903	0.08	0.76
NNE	16	97,034	0.39	2.45
Total		2,163,119	3.95	15.08

$\alpha$  Wind "toward."

to be practical for routine assessment activities and they have not been incorporated into AIRDOS-EPA.

Subsequent to the preparation of the population dose estimates for the TGHPD staff, measured net dose values were obtained from twenty TLD's placed around the TMI site prior to the incident. These TLD's were located in various directions from the plant at distances ranging from 0.16 to 24 km (Table 9). Comparisons were made between these measured total-body doses and values predicted using Eq. (1) and Eq. (2) assuming both an elevated release, as used above, and a ground-level (1 m) release. The latter release height was chosen to approximate the potential downdraft effects due to the presence of the buildings, and to compensate for the lack of a finite plume model in the code.

The four sets of total-body doses noted above were calculated assuming a total noble gas release of  $8.9 \times 10^{16}$  Bq. The results of these calculations as compared to the TLD measurements are shown in Table 9.

It has been reported (Kemeny, 1979), however, that the noble gas release may have been as high as  $4.8 \times 10^{17}$  Bq ( $1.3 \times 10^7$  Ci). Dose predictions based on this higher source term may be made by multiplying the original AIRDOS-EPA dose predictions by a factor of 5.4. This is possible because in a Gaussian plume model such as that used in AIRDOS-EPA the dose is directly proportional to the source term. Shown in Table 10 is a summary of a statistical analysis of the results of comparing the four sets of total-body dose predictions for the two different source terms. The  $22.5^\circ$  sector-averaged calculation assuming a ground-level release and using the lower source term seems to give the best overall comparison with the TLD measurements. Predictions assuming an elevated release do not seem to match well with the TLD measurements for either source term considered.

#### Revised Population Dose Estimates

Revised population dose estimates have now been made using Eq. (2) and assuming a ground-level (1 m) release. The total-body dose estimates resulting from this calculation are also shown in Table 8. Revised estimates for other organs are tabulated in Appendix C. The total



Table 10. Summary of a comparison between predicted and observed doses resulting from noble gas releases during the incident at the Three Mile Island Unit 2 nuclear reactor, March 28-April 15, 1979

Total noble gas release, Bq	Height of release, m	Type of Gaussian plume model calculation	Median value of the ratio (predicted dose) <sup>a</sup> / (observed dose)	Linear regression parameters, predicted dose vs observed dose		
				Slope <sup>b</sup>	Intercept <sup>b</sup>	Correlation coefficient <sup>c</sup>
$8.9 \times 10^{16}$	1	22.5° sector average	1.6	1.4	56	0.86
			5.5	3.6	300	0.81
	55	centerline	5.2	0	1.6	0.04
			0.024	0	0.82	0.07
	55	22.5° sector average	8.9	7.3	300	0.86
			30	20	1600	0.81
$4.8 \times 10^{17}$	1	22.5° sector average	28	0	8.7	0.04
			28	0	4.4	0.07
	55	22.5° sector average	0.13	0	0	

<sup>a</sup>A value of 1 signifies perfect agreement between predicted dose and observed dose.

<sup>b</sup>A perfect fit would result in a slope of 1 and an intercept of 0.

<sup>c</sup>Maximum value = 1.

dose to the population within 80 km is 15 person-Sv, which is within a factor of 2 of that extrapolated from the TLD measurements (28 person-Sv).

## DISCUSSION

### Potential Sources of Error

There are a number of potential sources of error in these calculations that should be noted. The results of any Gaussian plume model calculation are directly proportional to the source term used as input if all other parameters are assumed constant. As a result, any error in the composition or magnitude of the assumed TMI source term will result in a like error in the dose.

The Gaussian plume dispersion parameters used in AIRDOS-EPA are based primarily on data measured over relatively flat terrain. As shown in Fig. 1, the TMI site is located in a river valley surrounded by rolling terrain. The Gaussian model may not be as accurate under these conditions as it is for flat terrain (Little and Miller, 1979).

More information is needed on the behavior of plumes around building complexes such as the TMI site. It is unlikely that the TMI plume was brought to ground 100% of the time during the release, but no information seems to be available on the behavior of the plume around the structures. Such information could help increase the accuracy of the dose calculations.

AIRDOS-EPA is designed primarily for estimating long-term average doses from continuous releases of radionuclides, not relatively short-term releases like those considered here. The uncertainty associated with such short-term calculations is undoubtedly larger than the uncertainty associated with long-term averages (Little and Miller, 1979).

### Potential Health Effects

There is no universally accepted method for estimating health effects from low-level radiation. The data from the Report on the Biological Effects of Ionizing Radiation (BEIR Report)(National Academy of Science, 1972), however, has been widely used in associating a risk

factor with ionizing radiation. As a result, we based our potential health effects from the TMI incident on the BEIR Report data as interpreted by the U. S. Environmental Protection Agency (EPA)(USEPA, 1976). The linear hypothesis is assumed to be true in the EPA risk factors. It is not our contention that the linear hypothesis is correct; but that it is possibly more conservative than the threshold hypothesis.

It has been estimated that the excess cancer mortality risk (including leukemia mortality) from total-body irradiation is  $2 \times 10^{-2}$  cancer deaths per person-Sv of annual exposure. Our doses are actually based on the total accidental (19-day) release, but they are calculated as an annual dose. Assuming 15 person-Sv as the population dose, an excess of 0.3 cancer deaths could be expected as a result of the TMI incident. This risk factor is in close agreement with the factors recommended by International Commission on Radiation Protection in its Publication 26 (ICRP, 1977).

The total cancer risk (including mortality) is estimated as  $4 \times 10^{-2}$  cancers per year per person-Sv of total-body exposure. Thus, the total number of cancers expected as a result of TMI is 0.6.

Natural background radiation consists of cosmic rays, terrestrial radioactive materials, and internally-deposited radionuclides occurring in nature. For Pennsylvania, it is estimated that an average of 0.45 milli Sv/year are received by each individual from total-body exposure to cosmic rays with another 0.55 milli Sv/year from terrestrial radioactivity and 0.25 milli Sv/year from internal radionuclides (USEPA, 1972). The dose to the population living within 80 km of TMI (2,163,119 persons), therefore, will likely receive about 2,700 person-Sv from these forms of natural background radioactivity.

The population dose calculated as a result of the TMI incident (15 person-Sv) represents less than 0.6% of the dose received from natural background.

To put the excess population dose resulting from the TMI incident (i.e., 15 person-Sv) into perspective with the dose received from natural background, the health risk factors used previously are applied here to doses from natural background radiation.

The cancer mortality risk factor of  $2 \times 10^{-2}$  deaths per person-Sv of exposure per year yields an estimated 54 cancer deaths from natural background radiation exposure (2,700 person-Sv for the population around TMI) as compared to 0.3 deaths expected as a result of the accident. This represents an increase of less than 0.6% in the cancer mortality for that population group.

The total cancer risk from natural background exposure (which includes mortality) based on  $4 \times 10^{-2}$  cancers per person-Sv of exposure per year is estimated at 108 cancers as compared to 0.6 cancers resulting from TMI.

#### CONCLUSIONS

The AIRDOS-EPA computer code has been used to estimate the total-body dose to the population within 80 km due to noble gas releases from the TMI incident. These calculations are based on a 22.5° sector-averaged Gaussian plume atmospheric dispersion model assuming a ground-level release. The latter assumption was used because it resulted in better agreement between observed and predicted TLD doses than did use of an elevated release in the model. Our value of 15 person-Sv is within a factor of 2 of the 28 person-Sv estimated from extrapolation of TLD measurements without considering shielding effects due to dwellings. It has been estimated that the population dose received from the TMI incident is too small to cause any detectable physical health effects.



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APPENDIX A

METEOROLOGICAL AND RELEASE DATA





DATE	HOUR OF RELEASE	AMOUNT OF RELEASE (g/m)	WEATHERLOGICAL AND RELEASE DATA					
			WIND SPEED (m/sec)	TEMPERATURE GRADIENT (DEGREES C PER 100M)	PASCHILL STABILITY CATEGORY	WIND DIRECTION (DEGREES)	WIND WARD (DEGREES)	SECTION
30 MAR 79	1000	200	0.3	-0.3	0	100	256	E
30 MAR 79	1100	200	0.6	-0.6	0	44	44	NE
30 MAR 79	1200	200	0.6	-0.6	0	321	321	NNW
30 MAR 79	1300	200	0.6	-0.6	0	13	13	NNE
30 MAR 79	1400	200	0.6	-0.6	0	282	282	NNN
30 MAR 79	1500	200	0.6	-0.6	0	667	667	N
30 MAR 79	1600	200	0.6	-0.6	0	312	312	NNN
30 MAR 79	1700	200	0.6	-0.6	0	354	354	NNN
30 MAR 79	1800	200	0.6	-0.6	0	320	320	NN
30 MAR 79	1900	200	0.6	-0.6	0	16	16	NN
30 MAR 79	2000	200	0.6	-0.6	0	59	59	NN
30 MAR 79	2100	200	0.6	-0.6	0	43	43	NN
30 MAR 79	2200	200	0.6	-0.6	0	47	47	NN
31 MAR 79	000	250	0.6	-0.6	0	28	28	NN
31 MAR 79	010	250	0.6	-0.6	0	110	110	NN
31 MAR 79	020	250	0.6	-0.6	0	40	40	NN
31 MAR 79	030	250	0.6	-0.6	0	50	50	NN
31 MAR 79	040	250	0.6	-0.6	0	37	37	NN
31 MAR 79	050	250	0.6	-0.6	0	43	43	NN
31 MAR 79	060	250	0.6	-0.6	0	50	50	NN
31 MAR 79	070	250	0.6	-0.6	0	34	34	NN
31 MAR 79	080	250	0.6	-0.6	0	44	44	NN
31 MAR 79	090	250	0.6	-0.6	0	54	54	NN
31 MAR 79	100	250	0.6	-0.6	0	37	37	NN
31 MAR 79	110	250	0.6	-0.6	0	40	40	NN
31 MAR 79	120	250	0.6	-0.6	0	26	26	NN
31 MAR 79	130	250	0.6	-0.6	0	30	30	NN
31 MAR 79	1400	250	0.6	-0.6	0	141	141	NN
31 MAR 79	1500	250	0.6	-0.6	0	80	80	NN
31 MAR 79	1600	250	0.6	-0.6	0	36	36	NN
31 MAR 79	1700	250	0.6	-0.6	0	112	112	NN
31 MAR 79	1800	250	0.6	-0.6	0	270	270	NN
31 MAR 79	1900	250	0.6	-0.6	0	253	253	NN
31 MAR 79	2000	250	0.6	-0.6	0	71	71	NN
31 MAR 79	2100	250	0.6	-0.6	0	172	172	NN
31 MAR 79	2200	250	0.6	-0.6	0	53	53	NN
31 MAR 79	2300	250	0.6	-0.6	0	133	133	NN
31 MAR 79	2400	250	0.6	-0.6	0	222	222	NN
31 MAR 79	2500	250	0.6	-0.6	0	159	159	NN
31 MAR 79	2600	250	0.6	-0.6	0	-	-	NN
31 MAR 79	2700	250	0.6	-0.6	0	-	-	NN
31 MAR 79	2800	250	0.6	-0.6	0	-	-	NN
31 MAR 79	2900	250	0.6	-0.6	0	-	-	NN
31 MAR 79	3000	250	0.6	-0.6	0	-	-	NN
31 MAR 79	3100	250	0.6	-0.6	0	-	-	NN
31 MAR 79	3200	250	0.6	-0.6	0	-	-	NN
31 MAR 79	3300	250	0.6	-0.6	0	-	-	NN
31 MAR 79	3400	250	0.6	-0.6	0	-	-	NN
31 MAR 79	3500	250	0.6	-0.6	0	-	-	NN
31 MAR 79	3600	250	0.6	-0.6	0	-	-	NN
31 MAR 79	3700	250	0.6	-0.6	0	-	-	NN
31 MAR 79	3800	250	0.6	-0.6	0	-	-	NN
31 MAR 79	3900	250	0.6	-0.6	0	-	-	NN
31 MAR 79	4000	250	0.6	-0.6	0	-	-	NN
31 MAR 79	4100	250	0.6	-0.6	0	-	-	NN
31 MAR 79	4200	250	0.6	-0.6	0	-	-	NN
31 MAR 79	4300	250	0.6	-0.6	0	-	-	NN
31 MAR 79	4400	250	0.6	-0.6	0	-	-	NN
31 MAR 79	4500	250	0.6	-0.6	0	-	-	NN
31 MAR 79	4600	250	0.6	-0.6	0	-	-	NN
31 MAR 79	4700	250	0.6	-0.6	0	-	-	NN
31 MAR 79	4800	250	0.6	-0.6	0	-	-	NN
31 MAR 79	4900	250	0.6	-0.6	0	-	-	NN
31 MAR 79	5000	250	0.6	-0.6	0	-	-	NN
31 MAR 79	5100	250	0.6	-0.6	0	-	-	NN
31 MAR 79	5200	250	0.6	-0.6	0	-	-	NN
31 MAR 79	5300	250	0.6	-0.6	0	-	-	NN
31 MAR 79	5400	250	0.6	-0.6	0	-	-	NN
31 MAR 79	5500	250	0.6	-0.6	0	-	-	NN
31 MAR 79	5600	250	0.6	-0.6	0	-	-	NN
31 MAR 79	5700	250	0.6	-0.6	0	-	-	NN
31 MAR 79	5800	250	0.6	-0.6	0	-	-	NN
31 MAR 79	5900	250	0.6	-0.6	0	-	-	NN
31 MAR 79	6000	250	0.6	-0.6	0	-	-	NN
31 MAR 79	6100	250	0.6	-0.6	0	-	-	NN
31 MAR 79	6200	250	0.6	-0.6	0	-	-	NN
31 MAR 79	6300	250	0.6	-0.6	0	-	-	NN
31 MAR 79	6400	250	0.6	-0.6	0	-	-	NN
31 MAR 79	6500	250	0.6	-0.6	0	-	-	NN
31 MAR 79	6600	250	0.6	-0.6	0	-	-	NN
31 MAR 79	6700	250	0.6	-0.6	0	-	-	NN
31 MAR 79	6800	250	0.6	-0.6	0	-	-	NN
31 MAR 79	6900	250	0.6	-0.6	0	-	-	NN
31 MAR 79	7000	250	0.6	-0.6	0	-	-	NN
31 MAR 79	7100	250	0.6	-0.6	0	-	-	NN
31 MAR 79	7200	250	0.6	-0.6	0	-	-	NN
31 MAR 79	7300	250	0.6	-0.6	0	-	-	NN
31 MAR 79	7400	250	0.6	-0.6	0	-	-	NN
31 MAR 79	7500	250	0.6	-0.6	0	-	-	NN
31 MAR 79	7600	250	0.6	-0.6	0	-	-	NN
31 MAR 79	7700	250	0.6	-0.6	0	-	-	NN
31 MAR 79	7800	250	0.6	-0.6	0	-	-	NN
31 MAR 79	7900	250	0.6	-0.6	0	-	-	NN
31 MAR 79	8000	250	0.6	-0.6	0	-	-	NN
31 MAR 79	8100	250	0.6	-0.6	0	-	-	NN
31 MAR 79	8200	250	0.6	-0.6	0	-	-	NN
31 MAR 79	8300	250	0.6	-0.6	0	-	-	NN
31 MAR 79	8400	250	0.6	-0.6	0	-	-	NN
31 MAR 79	8500	250	0.6	-0.6	0	-	-	NN
31 MAR 79	8600	250	0.6	-0.6	0	-	-	NN
31 MAR 79	8700	250	0.6	-0.6	0	-	-	NN
31 MAR 79	8800	250	0.6	-0.6	0	-	-	NN
31 MAR 79	8900	250	0.6	-0.6	0	-	-	NN
31 MAR 79	9000	250	0.6	-0.6	0	-	-	NN
31 MAR 79	9100	250	0.6	-0.6	0	-	-	NN
31 MAR 79	9200	250	0.6	-0.6	0	-	-	NN
31 MAR 79	9300	250	0.6	-0.6	0	-	-	NN
31 MAR 79	9400	250	0.6	-0.6	0	-	-	NN
31 MAR 79	9500	250	0.6	-0.6	0	-	-	NN
31 MAR 79	9600	250	0.6	-0.6	0	-	-	NN
31 MAR 79	9700	250	0.6	-0.6	0	-	-	NN
31 MAR 79	9800	250	0.6	-0.6	0	-	-	NN
31 MAR 79	9900	250	0.6	-0.6	0	-	-	NN
31 MAR 79	10000	250	0.6	-0.6	0	-	-	NN
31 MAR 79	11000	250	0.6	-0.6	0	-	-	NN
31 MAR 79	12000	250	0.6	-0.6	0	-	-	NN
31 MAR 79	13000	250	0.6	-0.6	0	-	-	NN

I-41t	TIME OF RELEASE	AMOUNT OF RELEASE (ml.)	SPEEch (x/sec)	TEMPERATURE (DEGREES C PER 100M)	GRADIENT (DEGREES C PER 100M)	PASCHILL STABILITY CATEGORY	NINIO DIRECTION (DEGREES)	NINIO POSITION (DEGREES TOWARD (DEGREES))	STC/NR																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900	4000	4100	4200	4300	4400	4500	4600	4700	4800	4900	5000	5100	5200	5300	5400	5500	5600	5700	5800	5900	6000	6100	6200	6300	6400	6500	6600	6700	6800	6900	7000	7100	7200	7300	7400	7500	7600	7700	7800	7900	8000	8100	8200	8300	8400	8500	8600	8700	8800	8900	9000	9100	9200	9300	9400	9500	9600	9700	9800	9900	10000	10100	10200	10300	10400	10500	10600	10700	10800	10900	11000	11100	11200	11300	11400	11500	11600	11700	11800	11900	12000	12100	12200	12300	12400	12500	12600	12700	12800	12900	13000	13100	13200	13300	13400	13500	13600	13700	13800	13900	14000	14100	14200	14300	14400	14500	14600	14700	14800	14900	15000	15100	15200	15300	15400	15500	15600	15700	15800	15900	16000	16100	16200	16300	16400	16500	16600	16700	16800	16900	17000	17100	17200	17300	17400	17500	17600	17700	17800	17900	18000	18100	18200	18300	18400	18500	18600	18700	18800	18900	19000	19100	19200	19300	19400	19500	19600	19700	19800	19900	20000	20100	20200	20300	20400	20500	20600	20700	20800	20900	21000	21100	21200	21300	21400	21500	21600	21700	21800	21900	22000	22100	22200	22300	22400	22500	22600	22700	22800	22900	23000	23100	23200	23300	23400	23500	23600	23700	23800	23900	24000	24100	24200	24300	24400	24500	24600	24700	24800	24900	25000	25100	25200	25300	25400	25500	25600	25700	25800	25900	26000	26100	26200	26300	26400	26500	26600	26700	26800	26900	27000	27100	27200	27300	27400	27500	27600	27700	27800	27900	28000	28100	28200	28300	28400	28500	28600	28700	28800	28900	29000	29100	29200	29300	29400	29500	29600	29700	29800	29900	30000	30100	30200	30300	30400	30500	30600	30700	30800	30900	31000	31100	31200	31300	31400	31500	31600	31700	31800	31900	32000	32100	32200	32300	32400	32500	32600	32700	32800	32900	33000	33100	33200	33300	33400	33500	33600	33700	33800	33900	34000	34100	34200	34300	34400	34500	34600	34700	34800	34900	35000	35100	35200	35300	35400	35500	35600	35700	35800	35900	36000	36100	36200	36300	36400	36500	36600	36700	36800	36900	37000	37100	37200	37300	37400	37500	37600	37700	37800	37900	38000	38100	38200	38300	38400	38500	38600	38700	38800	38900	39000	39100	39200	39300	39400	39500	39600	39700	39800	39900	40000	40100	40200	40300	40400	40500	40600	40700	40800	40900	41000	41100	41200	41300	41400	41500	41600	41700	41800	41900	42000	42100	42200	42300	42400	42500	42600	42700	42800	42900	43000	43100	43200	43300	43400	43500	43600	43700	43800	43900	44000	44100	44200	44300	44400	44500	44600	44700	44800	44900	45000	45100	45200	45300	45400	45500	45600	45700	45800	45900	46000	46100	46200	46300	46400	46500	46600	46700	46800	46900	47000	47100	47200	47300	47400	47500	47600	47700	47800	47900	48000	48100	48200	48300	48400	48500	48600	48700	48800	48900	49000	49100	49200	49300	49400	49500	49600	49700	49800	49900	50000	50100	50200	50300	50400	50500	50600	50700	50800	50900	51000	51100	51200	51300	51400	51500	51600	51700	51800	51900	52000	52100	52200	52300	52400	52500	52600	52700	52800	52900	53000	53100	53200	53300	53400	53500	53600	53700	53800	53900	54000	54100	54200	54300	54400	54500	54600	54700	54800	54900	55000	55100	55200	55300	55400	55500	55600	55700	55800	55900	56000	56100	56200	56300	56400	56500	56600	56700	56800	56900	57000	57100	57200	57300	57400	57500	57600	57700	57800	57900	58000	58100	58200	58300	58400	58500	58600	58700	58800	58900	59000	59100	59200	59300	59400	59500	59600	59700	59800	59900	60000	60100	60200	60300	60400	60500	60600	60700	60800	60900	61000	61100	61200	61300	61400	61500	61600	61700	61800	61900	62000	62100	62200	62300	62400	62500	62600	62700	62800	62900	63000	63100	63200	63300	63400	63500	63600	63700	63800	63900	64000	64100	64200	64300	64400	64500	64600	64700	64800	64900	65000	65100	65200	65300	65400	65500	65600	65700	65800	65900	66000	66100	66200	66300	66400	66500	66600	66700	66800	66900	67000	67100	67200	67300	67400	67500	67600	67700	67800	67900	68000	68100	68200	68300	68400	68500	68600	68700	68800	68900	69000	69100	69200	69300	69400	69500	69600	69700	69800	69900	70000	70100	70200	70300	70400	70500	70600	70700	70800	70900	71000	71100	71200	71300	71400	71500	71600	71700	71800	71900	72000	72100	72200	72300	72400	72500	72600	72700	72800	72900	73000	73100	73200	73300	73400	73500	73600	73700	73800	73900	74000	74100	74200	74300	74400	74500	74600	74700	74800	74900	75000	75100	75200	75300	75400	75500	75600	75700	75800	75900	76000	76100	76200	76300	76400	76500	76600	76700	76800	76900	77000	77100	77200	77300	77400	77500	77600	77700	77800	77900	78000	78100	78200	78300	78400	78500	78600	78700	78800	78900	79000	79100	79200	79300	79400	79500	79600	79700	79800	79900	80000	80100	80200	80300	80400	80500	80600	80700	80800	80900	81000	81100	81200	81300	81400	81500	81600	81700	81800	81900	82000	82100	82200	82300	82400	82500	82600	82700	82800	82900	83000	83100	83200	83300	83400	83500	83600	83700	83800	83900	84000	84100	84200	84300	84400	84500	84600	84700	84800	84900	85000	85100	85200	85300	85400	85500	85600	85700	85800	85900	86000	86100	86200	86300	86400	86500	86600	86700	86800	86900	87000	87100	87200	87300	87400	87500	87600	87700	87800	87900	88000	88100	88200	88300	88400	88500	88600	88700	88800	88900	89000	89100	89200	89300	89400	89500	89600	89700	89800	89900	90000	90100	90200	90300	90400	90500	90600	90700	90800	90900	91000	91100	91200	91300	91400	91500	91600	91700	91800	91900	92000	92100	92200	92300	92400	92500	92600	92700	92800	92900	93000	93100	93200	93300	93400	93500	93600	93700	93800	93900	94000	94100	94200	94300	94400	94500	94600	94700	94800	94900	95000	95100	95200	95300	95400	95500	95600	95700	95800	95900	96000	96100	96200	96300	96400	96500	96600	96700	96800	96900	97000	97100	97200	97300	97400	97500	97600	97700	97800	97900	98000	98100	98200	98300	98400	98500	98600	98700	98800	98900	99000	99100	99200	99300	99400	99500	99600	99700	99800	99900	100000	100100	100200	100300	100400	100500	100600	100700	100800	100900	101000	101100	101200	101300	101400	101500	101600	101700	101800	101900	102000	102100	102200	102300	102400	102500	102600	102700	102800	102900	103000	103100	103200	103300	103400	103500	103600	103700	103800	103900	104000	104100	104200	104300	104400	104500	104600	104700	104800	104900	105000	105100	105200	105300	105400	105500	105600	105700	105800	105900	106000	106100	106200	106300	106400	106500	106600	106700	106800	106900	107000	107100	107200	107300	107400	107500	107600	107700	107800	107900	108000	108100	108200	108300	108400	108500	108600	108700	108800	108900	109000	109100	109200	109300	109400	109500	109600	109700	109800	109900	110000	110100	110200	110300	110400	110500	110600	110700	110800	110900	111000	111100	111200	111300	111400	111500	111600	111700	111800	111900	112000	112100	112200	112300	112400	112

DATE	HOUR OF RELEASE	AMOUNT OF RELEASE (KG)	WEATHERLOGICAL AND RELEASE DATA		WIND DIRECTION TOWARD (DEGREES)	SECTOR
			WIND SPEED (M/SEC)	TEMPERATURE GRADIENT (DEGREES C PER 100M)		
03 APR 79	1800	2300	0.7	2.3	SSE	SSE
03 APR 79	1900	2200	0.7	2.3	SSE	SSE
03 APR 79	2000	2000	0.7	2.3	SSE	SSE
03 APR 79	2100	2000	0.7	2.3	SSE	SSE
03 APR 79	2200	2000	0.7	2.3	SSE	SSE
03 APR 79	2300	2000	0.7	2.3	SSE	SSE
04 APR 79	0000	2000	0.7	2.3	SSE	SSE
04 APR 79	0100	2000	0.7	2.3	SSE	SSE
04 APR 79	0200	2000	0.7	2.3	SSE	SSE
04 APR 79	0300	2000	0.7	2.3	SSE	SSE
04 APR 79	0400	2000	0.7	2.3	SSE	SSE
04 APR 79	0500	2000	0.7	2.3	SSE	SSE
04 APR 79	0600	2000	0.7	2.3	SSE	SSE
04 APR 79	0700	2000	0.7	2.3	SSE	SSE
04 APR 79	0800	2000	0.7	2.3	SSE	SSE
04 APR 79	0900	2000	0.7	2.3	SSE	SSE
04 APR 79	1000	2000	0.7	2.3	SSE	SSE
04 APR 79	1100	2000	0.7	2.3	SSE	SSE
04 APR 79	1200	2000	0.7	2.3	SSE	SSE
04 APR 79	1300	2000	0.7	2.3	SSE	SSE
04 APR 79	1400	2000	0.7	2.3	SSE	SSE
04 APR 79	1500	2000	0.7	2.3	SSE	SSE
04 APR 79	1600	2000	0.7	2.3	SSE	SSE
04 APR 79	1700	2000	0.7	2.3	SSE	SSE
04 APR 79	1800	2000	0.7	2.3	SSE	SSE
04 APR 79	1900	2000	0.7	2.3	SSE	SSE
04 APR 79	2000	2000	0.7	2.3	SSE	SSE
04 APR 79	2100	2000	0.7	2.3	SSE	SSE
04 APR 79	2200	2000	0.7	2.3	SSE	SSE
04 APR 79	2300	2000	0.7	2.3	SSE	SSE
05 APR 79	0000	2000	0.7	2.3	SSE	SSE
05 APR 79	0100	2000	0.7	2.3	SSE	SSE
05 APR 79	0200	2000	0.7	2.3	SSE	SSE
05 APR 79	0300	2000	0.7	2.3	SSE	SSE
05 APR 79	0400	2000	0.7	2.3	SSE	SSE
05 APR 79	0500	2000	0.7	2.3	SSE	SSE
05 APR 79	0600	2000	0.7	2.3	SSE	SSE
05 APR 79	0700	2000	0.7	2.3	SSE	SSE
05 APR 79	0800	2000	0.7	2.3	SSE	SSE
05 APR 79	0900	2000	0.7	2.3	SSE	SSE
05 APR 79	1000	2000	0.7	2.3	SSE	SSE
05 APR 79	1100	2000	0.7	2.3	SSE	SSE
05 APR 79	1200	2000	0.7	2.3	SSE	SSE
05 APR 79	1300	2000	0.7	2.3	SSE	SSE
05 APR 79	1400	2000	0.7	2.3	SSE	SSE
05 APR 79	1500	2000	0.7	2.3	SSE	SSE
05 APR 79	1600	2000	0.7	2.3	SSE	SSE
05 APR 79	1700	2000	0.7	2.3	SSE	SSE
05 APR 79	1800	2000	0.7	2.3	SSE	SSE
05 APR 79	1900	2000	0.7	2.3	SSE	SSE
05 APR 79	2000	2000	0.7	2.3	SSE	SSE
05 APR 79	2100	2000	0.7	2.3	SSE	SSE



WIND SPEED (M/SEC)	IMPERVIOUS GRAIDENT (DEGREES C PER 100M)	PASIVILL STABILITY CATEGORY	WIND DIRECTION TOWARD (DEGREES)	WEATHER AND RELEASE DATA	
				AMOUNT OF RELEASE (KG)	HOUR OF RELEASE
1.0 APR 79	1.0	1.0	1.0	1.0	
1.2 APR 79	1.2	1.2	1.2	1.2	
1.3 APR 79	1.3	1.3	1.3	1.3	
1.4 APR 79	1.4	1.4	1.4	1.4	
1.5 APR 79	1.5	1.5	1.5	1.5	
1.6 APR 79	1.6	1.6	1.6	1.6	
1.7 APR 79	1.7	1.7	1.7	1.7	
1.8 APR 79	1.8	1.8	1.8	1.8	
1.9 APR 79	1.9	1.9	1.9	1.9	
2.0 APR 79	2.0	2.0	2.0	2.0	
2.1 APR 79	2.1	2.1	2.1	2.1	
2.2 APR 79	2.2	2.2	2.2	2.2	
2.3 APR 79	2.3	2.3	2.3	2.3	
2.4 APR 79	2.4	2.4	2.4	2.4	
2.5 APR 79	2.5	2.5	2.5	2.5	
2.6 APR 79	2.6	2.6	2.6	2.6	
2.7 APR 79	2.7	2.7	2.7	2.7	
2.8 APR 79	2.8	2.8	2.8	2.8	
2.9 APR 79	2.9	2.9	2.9	2.9	
3.0 APR 79	3.0	3.0	3.0	3.0	
3.1 APR 79	3.1	3.1	3.1	3.1	
3.2 APR 79	3.2	3.2	3.2	3.2	
3.3 APR 79	3.3	3.3	3.3	3.3	
3.4 APR 79	3.4	3.4	3.4	3.4	
3.5 APR 79	3.5	3.5	3.5	3.5	
3.6 APR 79	3.6	3.6	3.6	3.6	
3.7 APR 79	3.7	3.7	3.7	3.7	
3.8 APR 79	3.8	3.8	3.8	3.8	
3.9 APR 79	3.9	3.9	3.9	3.9	
4.0 APR 79	4.0	4.0	4.0	4.0	
4.1 APR 79	4.1	4.1	4.1	4.1	
4.2 APR 79	4.2	4.2	4.2	4.2	
4.3 APR 79	4.3	4.3	4.3	4.3	
4.4 APR 79	4.4	4.4	4.4	4.4	
4.5 APR 79	4.5	4.5	4.5	4.5	
4.6 APR 79	4.6	4.6	4.6	4.6	
4.7 APR 79	4.7	4.7	4.7	4.7	
4.8 APR 79	4.8	4.8	4.8	4.8	
4.9 APR 79	4.9	4.9	4.9	4.9	
5.0 APR 79	5.0	5.0	5.0	5.0	
5.1 APR 79	5.1	5.1	5.1	5.1	
5.2 APR 79	5.2	5.2	5.2	5.2	
5.3 APR 79	5.3	5.3	5.3	5.3	
5.4 APR 79	5.4	5.4	5.4	5.4	
5.5 APR 79	5.5	5.5	5.5	5.5	
5.6 APR 79	5.6	5.6	5.6	5.6	
5.7 APR 79	5.7	5.7	5.7	5.7	
5.8 APR 79	5.8	5.8	5.8	5.8	
5.9 APR 79	5.9	5.9	5.9	5.9	
6.0 APR 79	6.0	6.0	6.0	6.0	
6.1 APR 79	6.1	6.1	6.1	6.1	
6.2 APR 79	6.2	6.2	6.2	6.2	
6.3 APR 79	6.3	6.3	6.3	6.3	
6.4 APR 79	6.4	6.4	6.4	6.4	
6.5 APR 79	6.5	6.5	6.5	6.5	
6.6 APR 79	6.6	6.6	6.6	6.6	
6.7 APR 79	6.7	6.7	6.7	6.7	
6.8 APR 79	6.8	6.8	6.8	6.8	
6.9 APR 79	6.9	6.9	6.9	6.9	
7.0 APR 79	7.0	7.0	7.0	7.0	
7.1 APR 79	7.1	7.1	7.1	7.1	
7.2 APR 79	7.2	7.2	7.2	7.2	
7.3 APR 79	7.3	7.3	7.3	7.3	
7.4 APR 79	7.4	7.4	7.4	7.4	
7.5 APR 79	7.5	7.5	7.5	7.5	
7.6 APR 79	7.6	7.6	7.6	7.6	
7.7 APR 79	7.7	7.7	7.7	7.7	
7.8 APR 79	7.8	7.8	7.8	7.8	
7.9 APR 79	7.9	7.9	7.9	7.9	
8.0 APR 79	8.0	8.0	8.0	8.0	
8.1 APR 79	8.1	8.1	8.1	8.1	
8.2 APR 79	8.2	8.2	8.2	8.2	
8.3 APR 79	8.3	8.3	8.3	8.3	
8.4 APR 79	8.4	8.4	8.4	8.4	
8.5 APR 79	8.5	8.5	8.5	8.5	
8.6 APR 79	8.6	8.6	8.6	8.6	
8.7 APR 79	8.7	8.7	8.7	8.7	
8.8 APR 79	8.8	8.8	8.8	8.8	
8.9 APR 79	8.9	8.9	8.9	8.9	
9.0 APR 79	9.0	9.0	9.0	9.0	
9.1 APR 79	9.1	9.1	9.1	9.1	
9.2 APR 79	9.2	9.2	9.2	9.2	
9.3 APR 79	9.3	9.3	9.3	9.3	
9.4 APR 79	9.4	9.4	9.4	9.4	
9.5 APR 79	9.5	9.5	9.5	9.5	
9.6 APR 79	9.6	9.6	9.6	9.6	
9.7 APR 79	9.7	9.7	9.7	9.7	
9.8 APR 79	9.8	9.8	9.8	9.8	
9.9 APR 79	9.9	9.9	9.9	9.9	
10.0 APR 79	10.0	10.0	10.0	10.0	
10.1 APR 79	10.1	10.1	10.1	10.1	
10.2 APR 79	10.2	10.2	10.2	10.2	
10.3 APR 79	10.3	10.3	10.3	10.3	
10.4 APR 79	10.4	10.4	10.4	10.4	
10.5 APR 79	10.5	10.5	10.5	10.5	
10.6 APR 79	10.6	10.6	10.6	10.6	
10.7 APR 79	10.7	10.7	10.7	10.7	
10.8 APR 79	10.8	10.8	10.8	10.8	
10.9 APR 79	10.9	10.9	10.9	10.9	
11.0 APR 79	11.0	11.0	11.0	11.0	
11.1 APR 79	11.1	11.1	11.1	11.1	
11.2 APR 79	11.2	11.2	11.2	11.2	
11.3 APR 79	11.3	11.3	11.3	11.3	
11.4 APR 79	11.4	11.4	11.4	11.4	
11.5 APR 79	11.5	11.5	11.5	11.5	
11.6 APR 79	11.6	11.6	11.6	11.6	
11.7 APR 79	11.7	11.7	11.7	11.7	
11.8 APR 79	11.8	11.8	11.8	11.8	
11.9 APR 79	11.9	11.9	11.9	11.9	
12.0 APR 79	12.0	12.0	12.0	12.0	
12.1 APR 79	12.1	12.1	12.1	12.1	
12.2 APR 79	12.2	12.2	12.2	12.2	
12.3 APR 79	12.3	12.3	12.3	12.3	
12.4 APR 79	12.4	12.4	12.4	12.4	
12.5 APR 79	12.5	12.5	12.5	12.5	
12.6 APR 79	12.6	12.6	12.6	12.6	
12.7 APR 79	12.7	12.7	12.7	12.7	
12.8 APR 79	12.8	12.8	12.8	12.8	
12.9 APR 79	12.9	12.9	12.9	12.9	
13.0 APR 79	13.0	13.0	13.0	13.0	
13.1 APR 79	13.1	13.1	13.1	13.1	
13.2 APR 79	13.2	13.2	13.2	13.2	
13.3 APR 79	13.3	13.3	13.3	13.3	
13.4 APR 79	13.4	13.4	13.4	13.4	
13.5 APR 79	13.5	13.5	13.5	13.5	
13.6 APR 79	13.6	13.6	13.6	13.6	
13.7 APR 79	13.7	13.7	13.7	13.7	
13.8 APR 79	13.8	13.8	13.8	13.8	
13.9 APR 79	13.9	13.9	13.9	13.9	
14.0 APR 79	14.0	14.0	14.0	14.0	
14.1 APR 79	14.1	14.1	14.1	14.1	
14.2 APR 79	14.2	14.2	14.2	14.2	
14.3 APR 79	14.3	14.3	14.3	14.3	
14.4 APR 79	14.4	14.4	14.4	14.4	
14.5 APR 79	14.5	14.5	14.5	14.5	
14.6 APR 79	14.6	14.6	14.6	14.6	
14.7 APR 79	14.7	14.7	14.7	14.7	
14.8 APR 79	14.8	14.8	14.8	14.8	
14.9 APR 79	14.9	14.9	14.9	14.9	
15.0 APR 79	15.0	15.0	15.0	15.0	
15.1 APR 79	15.1	15.1	15.1	15.1	
15.2 APR 79	15.2	15.2	15.2	15.2	
15.3 APR 79	15.3	15.3	15.3	15.3	
15.4 APR 79	15.4	15.4	15.4	15.4	
15.5 APR 79	15.5	15.5	15.5	15.5	
15.6 APR 79	15.6	15.6	15.6	15.6	
15.7 APR 79	15.7	15.7	15.7	15.7	
15.8 APR 79	15.8	15.8	15.8	15.8	
15.9 APR 79	15.9	15.9	15.9	15.9	
16.0 APR 79	16.0	16.0	16.0	16.0	
16.1 APR 79	16.1	16.1	16.1	16.1	
16.2 APR 79	16.2	16.2	16.2	16.2	
16.3 APR 79	16.3	16.3	16.3	16.3	
16.4 APR 79	16.4	16.4	16.4	16.4	
16.5 APR 79	16.5	16.5	16.5	16.5	
16.6 APR 79	16.6	16.6	16.6	16.6	
16.7 APR 79	16.7	16.7	16.7	16.7	
16.8 APR 79	16.8	16.8	16.8	16.8	
16.9 APR 79					





DATE	HOUR OF RELEASE	AMOUNT OF RELEASE (KG)	TMI METEOROLOGICAL AND RELEASE DATA			WIND DIRECTION (DEGREES FORWARD)	WIND DIRECTION (DEGREES BACK)	STABILITY	CATEGORY
			WIND SPEED (M/SEC)	TEMPERATURE GRADIENT (DEGREES C PER 100M)	PASQUILL STABILITY				
14APR79	1400	1500	7.0	0.8	+	133	138	SE	SSE
14APR79	1600	1700	6.5	0.5	+	143	158	SS	SE
14APR79	1800	1900	2.1	0.2	+	188	193	NW	N
14APR79	2000	2100	2.1	0.2	+	193	198	L	NW
14APR79	2200	2300	2.1	0.2	+	198	203	WW	WW
14APR79	2400	2500	2.1	0.2	+	203	208	S	N
14APR79	2600	2700	2.1	0.2	+	208	213	NN	N
14APR79	2800	2900	2.1	0.2	+	213	218	ENE	NE
14APR79	3000	3100	2.1	0.2	+	218	223	FSE	NE
14APR79	3200	3300	2.1	0.2	+	223	228	NE	NE
14APR79	3400	3500	2.1	0.2	+	228	232	SE	SE
14APR79	3600	3700	2.1	0.2	+	232	237	SE	SE
14APR79	3800	3900	2.1	0.2	+	237	242	SE	SE
14APR79	4000	4100	2.1	0.2	+	242	247	SE	SE
14APR79	4200	4300	2.1	0.2	+	247	252	SE	SE
14APR79	4400	4500	2.1	0.2	+	252	257	SE	SE
14APR79	4600	4700	2.1	0.2	+	257	262	SE	SE
14APR79	4800	4900	2.1	0.2	+	262	267	SE	SE
14APR79	5000	5100	2.1	0.2	+	267	272	SE	SE
14APR79	5200	5300	2.1	0.2	+	272	277	SE	SE
14APR79	5400	5500	2.1	0.2	+	277	282	SE	SE
14APR79	5600	5700	2.1	0.2	+	282	287	SE	SE
14APR79	5800	5900	2.1	0.2	+	287	292	SE	SE
14APR79	6000	6100	2.1	0.2	+	292	297	SE	SE
14APR79	6200	6300	2.1	0.2	+	297	302	SE	SE
14APR79	6400	6500	2.1	0.2	+	302	307	SE	SE
14APR79	6600	6700	2.1	0.2	+	307	312	SE	SE
14APR79	6800	6900	2.1	0.2	+	312	317	SE	SE
14APR79	7000	7100	2.1	0.2	+	317	322	SE	SE
14APR79	7200	7300	2.1	0.2	+	322	327	SE	SE
14APR79	7400	7500	2.1	0.2	+	327	332	SE	SE
14APR79	7600	7700	2.1	0.2	+	332	337	SE	SE
14APR79	7800	7900	2.1	0.2	+	337	342	SE	SE
14APR79	8000	8100	2.1	0.2	+	342	347	SE	SE
14APR79	8200	8300	2.1	0.2	+	347	352	SE	SE
14APR79	8400	8500	2.1	0.2	+	352	357	SE	SE
14APR79	8600	8700	2.1	0.2	+	357	362	SE	SE
14APR79	8800	8900	2.1	0.2	+	362	367	SE	SE
14APR79	9000	9100	2.1	0.2	+	367	372	SE	SE
14APR79	9200	9300	2.1	0.2	+	372	377	SE	SE
14APR79	9400	9500	2.1	0.2	+	377	382	SE	SE
14APR79	9600	9700	2.1	0.2	+	382	387	SE	SE
14APR79	9800	9900	2.1	0.2	+	387	392	SE	SE
14APR79	10000	10100	2.1	0.2	+	392	397	SE	SE
14APR79	10200	10300	2.1	0.2	+	397	402	SE	SE
14APR79	10400	10500	2.1	0.2	+	402	407	SE	SE
14APR79	10600	10700	2.1	0.2	+	407	412	SE	SE
14APR79	10800	10900	2.1	0.2	+	412	417	SE	SE
14APR79	11000	11100	2.1	0.2	+	417	422	SE	SE
14APR79	11200	11300	2.1	0.2	+	422	427	SE	SE
14APR79	11400	11500	2.1	0.2	+	427	432	SE	SE
14APR79	11600	11700	2.1	0.2	+	432	437	SE	SE
14APR79	11800	11900	2.1	0.2	+	437	442	SE	SE
14APR79	12000	12100	2.1	0.2	+	442	447	SE	SE
14APR79	12200	12300	2.1	0.2	+	447	452	SE	SE
14APR79	12400	12500	2.1	0.2	+	452	457	SE	SE
14APR79	12600	12700	2.1	0.2	+	457	462	SE	SE
14APR79	12800	12900	2.1	0.2	+	462	467	SE	SE
14APR79	13000	13100	2.1	0.2	+	467	472	SE	SE
14APR79	13200	13300	2.1	0.2	+	472	477	SE	SE
14APR79	13400	13500	2.1	0.2	+	477	482	SE	SE
14APR79	13600	13700	2.1	0.2	+	482	487	SE	SE
14APR79	13800	13900	2.1	0.2	+	487	492	SE	SE
14APR79	14000	14100	2.1	0.2	+	492	497	SE	SE
14APR79	14200	14300	2.1	0.2	+	497	502	SE	SE
14APR79	14400	14500	2.1	0.2	+	502	507	SE	SE
14APR79	14600	14700	2.1	0.2	+	507	512	SE	SE
14APR79	14800	14900	2.1	0.2	+	512	517	SE	SE
14APR79	15000	15100	2.1	0.2	+	517	522	SE	SE
14APR79	15200	15300	2.1	0.2	+	522	527	SE	SE
14APR79	15400	15500	2.1	0.2	+	527	532	SE	SE
14APR79	15600	15700	2.1	0.2	+	532	537	SE	SE
14APR79	15800	15900	2.1	0.2	+	537	542	SE	SE
14APR79	16000	16100	2.1	0.2	+	542	547	SE	SE
14APR79	16200	16300	2.1	0.2	+	547	552	SE	SE
14APR79	16400	16500	2.1	0.2	+	552	557	SE	SE
14APR79	16600	16700	2.1	0.2	+	557	562	SE	SE
14APR79	16800	16900	2.1	0.2	+	562	567	SE	SE
14APR79	17000	17100	2.1	0.2	+	567	572	SE	SE
14APR79	17200	17300	2.1	0.2	+	572	577	SE	SE
14APR79	17400	17500	2.1	0.2	+	577	582	SE	SE
14APR79	17600	17700	2.1	0.2	+	582	587	SE	SE
14APR79	17800	17900	2.1	0.2	+	587	592	SE	SE
14APR79	18000	18100	2.1	0.2	+	592	597	SE	SE
14APR79	18200	18300	2.1	0.2	+	597	602	SE	SE
14APR79	18400	18500	2.1	0.2	+	602	607	SE	SE
14APR79	18600	18700	2.1	0.2	+	607	612	SE	SE
14APR79	18800	18900	2.1	0.2	+	612	617	SE	SE
14APR79	19000	19100	2.1	0.2	+	617	622	SE	SE
14APR79	19200	19300	2.1	0.2	+	622	627	SE	SE
14APR79	19400	19500	2.1	0.2	+	627	632	SE	SE
14APR79	19600	19700	2.1	0.2	+	632	637	SE	SE
14APR79	19800	19900	2.1	0.2	+	637	642	SE	SE
14APR79	20000	20100	2.1	0.2	+	642	647	SE	SE
14APR79	20200	20300	2.1	0.2	+	647	652	SE	SE
14APR79	20400	20500	2.1	0.2	+	652	657	SE	SE
14APR79	20600	20700	2.1	0.2	+	657	662	SE	SE
14APR79	20800	20900	2.1	0.2	+	662	667	SE	SE
14APR79	21000	21100	2.1	0.2	+	667	672	SE	SE
14APR79	21200	21300	2.1	0.2	+	672	677	SE	SE
14APR79	21400	21500	2.1	0.2	+	677	682	SE	SE
14APR79	21600	21700	2.1	0.2	+	682	687	SE	SE
14APR79	21800	21900	2.1	0.2	+	687	692	SE	SE
14APR79	22000	22100	2.1	0.2	+	692	697	SE	SE
14APR79	22200	22300	2.1	0.2	+	697	702	SE	SE
14APR79	22400	22500	2.1	0.2	+	702	707	SE	SE
14APR79	22600	22700	2.1	0.2	+	707	712	SE	SE
14APR79	22800	22900	2.1	0.2	+	712	717	SE	SE
14APR79	23000	23100	2.1	0.2	+	717	722	SE	SE
14APR79	23200	23300	2.1	0.2	+	722	727	SE	SE
14APR79	23400	23500	2.1	0.2	+	727	732	SE	SE
14APR79	23600	23700	2.1	0.2	+	732	737	SE	SE
14APR79	23800	23900	2.1	0.2	+	737	742	SE	SE
14APR79	24000	24100	2.1	0.2	+	742	747	SE	SE
14APR79	24200	24300	2.1	0.2	+	747	752	SE	SE
14APR79	24400	24500	2.1	0.2	+	752	757	SE	SE
14APR79	24600	24700	2.1	0.2	+	757	762	SE	SE
14APR79	24800	24900	2.1	0.2	+	762	767	SE	SE
14APR79	25000	25100	2.1	0.2	+	767	772	SE	SE
14APR79	25200	25300	2.1	0.2	+	772	777	SE	SE
14APR79	25400	25500	2.1	0.2	+	777	782	SE	SE
14APR79	25600	25700	2.1	0.2	+	782	787	SE	SE
14APR79	25800	25900	2.1	0.2	+	787	792	SE	SE
14APR79	26000	26100	2.1	0.2	+	792	797	SE	SE
14APR79	26200	26300	2.1	0.2	+	797	802	SE	SE
14APR79	26400	26500	2.1	0.2	+	802	807	SE	SE
14APR79	26600	26700	2.1	0.2	+	807	812	SE	SE
14APR79	26800	26900	2.1	0.2	+	812	817	SE	SE
14APR79	27000	2							



APPENDIX B

RELEASE RATE ESTIMATES FOR VARIOUS TIME PERIODS AS SUPPLIED  
BY THE TASK GROUP ON HEALTH PHYSICS AND DOSIMETRY



RELEASE RATE ESTIMATES (KV/VIN) AS SUPPLIED BY THE  
TASK GROUP ON HEALTH PHYSICS AND DOSEMTRY

DATE	TIME	RELEASE
28MAR79	600	3.5E+09
28MAR79	700	5.2E+09
28MAR79	708	3.5E+10
28MAR79	715	5.2E+10
28MAR79	723	8.5E+11
28MAR79	730	1.4E+12
28MAR79	753	1.0E+12
28MAR79	800	8.5E+11
28MAR79	808	5.9E+11
28MAR79	815	7.0E+11
28MAR79	822	3.5E+11
28MAR79	900	7.0E+11
28MAR79	907	1.7E+12
28MAR79	915	2.6E+12
28MAR79	923	3.5E+12
28MAR79	930	4.4E+12
28MAR79	945	5.5E+12
28MAR79	953	8.5E+12
28MAR79	1000	1.2E+13
28MAR79	1007	1.7E+13
28MAR79	1023	1.7E+13
28MAR79	1045	1.5E+13
28MAR79	1053	1.2E+13
28MAR79	1100	1.3E+13
28MAR79	1200	8.5E+12
28MAR79	1300	1.4E+13
28MAR79	1308	1.1E+13
28MAR79	1315	2.6E+13
28MAR79	1323	2.3E+13
28MAR79	1330	1.7E+13
28MAR79	1345	1.5E+13
28MAR79	1353	1.2E+13
28MAR79	1415	9.6E+13
28MAR79	1445	6.7E+13
28MAR79	1453	7.8E+13
28MAR79	1530	1.4E+14
28MAR79	1553	1.2E+14
28MAR79	1600	9.6E+13
28MAR79	1630	3.7E+13
28MAR79	1900	2.8E+13
28MAR79	1930	2.3E+13
28MAR79	2015	5.5E+13
28MAR79	2023	7.4E+13
28MAR79	2038	9.3E+13
28MAR79	2045	1.1E+14
28MAR79	2100	1.0E+14
28MAR79	2238	8.5E+13
28MAR79	2253	9.3E+13
28MAR79	2330	3.7E+13
29MAR79	0	2.8E+13
29MAR79	30	2.3E+13
29MAR79	100	3.7E+13
29MAR79	300	2.5E+13

**RELEASE RATE ESTIMATES (PPM/L) AS SUPPLIED BY THE  
FISH GROUP IN THE LAKE POWELL AND GULCH RIVER**

DATE	TIME	RELEASE
29 APR 79	410	1.8E+13
29 APR 79	450	5.7E+13
29 APR 79	510	7.4E+13
29 APR 79	550	6.7E+13
29 APR 79	600	3.4E+13
29 APR 79	700	1.5E+13
29 APR 79	800	1.1E+13
29 APR 79	900	7.4E+12
29 APR 79	1130	5.4E+12
29 APR 79	1300	5.5E+12
29 APR 79	1500	7.4E+12
29 APR 79	1700	2.3E+12
29 APR 79	2330	1.5E+12
30 APR 79	0	5.7E+12
30 APR 79	30	1.8E+12
30 APR 79	200	2.8E+12
30 APR 79	208	4.8E+12
30 APR 79	215	5.5E+12
30 APR 79	225	4.8E+12
30 APR 79	230	5.7E+12
30 APR 79	300	1.8E+12
30 APR 79	330	1.5E+12
30 APR 79	338	1.7E+12
30 APR 79	345	2.8E+12
30 APR 79	345	3.0E+12
30 APR 79	410	2.3E+12
30 APR 79	450	1.5E+12
30 APR 79	550	7.4E+11
30 APR 79	600	9.3E+11
30 APR 79	650	5.7E+12
30 APR 79	700	1.8E+12
30 APR 79	800	1.1E+13
30 APR 79	900	7.4E+12
30 APR 79	1000	5.7E+12
30 APR 79	1200	5.5E+12
31 APR 79	1700	3.4E+12
31 APR 79	1800	2.4E+12
31 APR 79	1900	1.7E+12
31 APR 79	2100	2.5E+12
01 APR 79	500	1.9E+12
01 APR 79	438	4.8E+12
01 APR 79	445	3.7E+12
01 APR 79	500	2.8E+12
01 APR 79	600	1.9E+12
01 APR 79	650	2.8E+12
01 APR 79	700	1.9E+12
01 APR 79	1400	1.7E+12
01 APR 79	1405	2.3E+12
01 APR 79	1408	1.9E+12
02 APR 79	700	1.5E+12
02 APR 79	900	1.2E+12
02 APR 79	1000	9.3E+11
02 APR 79	1100	9.6E+11

RELEASE RATE (SST) AFTER CORRECTION AS SUPPLIED BY THE  
LAB GROUP ON HEALTH PHYSICS AND DOSIMETRY

DATE	TIME	RELEASE
02 APR 79	1122	0.5E+11
02 APR 79	1155	0.5E+11
02 APR 79	1200	1.0E+12
02 APR 79	2000	1.1E+12
03 APR 79	15	1.4E+12
03 APR 79	200	1.7E+12
03 APR 79	400	1.4E+12
03 APR 79	500	1.5E+12
03 APR 79	600	1.3E+12
03 APR 79	1100	1.2E+12
03 APR 79	1500	8.5E+11
03 APR 79	2100	9.5E+11
04 APR 79	900	6.7E+11
04 APR 79	1400	5.4E+11
04 APR 79	1800	7.8E+11
04 APR 79	2000	3.7E+11
04 APR 79	2100	6.7E+11
05 APR 79	300	5.5E+11
05 APR 79	400	3.2E+11
05 APR 79	500	0.7E+11
05 APR 79	700	2.3E+11
05 APR 79	800	5.5E+11
05 APR 79	1030	1.9E+11
05 APR 79	1700	3.7E+11
05 APR 79	2100	3.4E+11
06 APR 79	0	1.5E+11
06 APR 79	500	1.3E+11
06 APR 79	600	1.5E+11
06 APR 79	623	4.8E+11
06 APR 79	638	7.4E+11
06 APR 79	800	5.5E+11
06 APR 79	1000	3.7E+11
06 APR 79	1100	5.5E+11
06 APR 79	1223	3.4E+11
06 APR 79	1300	4.8E+11
06 APR 79	1400	3.4E+11
06 APR 79	1500	2.8E+11
06 APR 79	1600	2.4E+11
06 APR 79	2000	4.4E+11
06 APR 79	2100	3.7E+11
06 APR 79	2158	1.9E+11
06 APR 79	2200	1.7E+11
06 APR 79	2300	1.3E+11
07 APR 79	100	1.5E+11
07 APR 79	245	2.8E+11
07 APR 79	300	3.7E+11
07 APR 79	600	2.3E+11
07 APR 79	700	2.8E+11
07 APR 79	1400	1.9E+11
07 APR 79	1500	2.8E+11
07 APR 79	1700	3.7E+11
07 APR 79	1800	1.9E+11
07 APR 79	1900	1.7E+11

RELEASE RATE ESTIMATES (mV/m<sup>3</sup>) AS SUPPLIED BY THE  
TASK GROUP IN HEALTH PHYSICS AND DOSEMETRY

DATE	TIME	RELEASE
07APR79	2100	1.1E+11
07APR79	2300	3.7E+11
08APR79	0	2.8E+11
08APR79	500	1.9E+11
09APR79	600	1.9E+11
09APR79	900	3.7E+11
09APR79	1300	4.8E+11
10APR79	0	5.2E+11
16APR79	0	5.2E+11

APPENDIX C

POPULATION DOSES TO THE TOTAL BODY AND VARIOUS  
ORGANS OF INTEREST



Population dose to the total body and various organs as calculated by the AIRDOS-EPA code for each sector

Sector	Total body	Red marrow	Lungs	Endosteal cells	Dose (person-Sv)						
					Stomach wall	Lower large intestine wall	Thyroid	Liver	Kidneys	Testes	Ovaries
1	2.45	3.49	2.08	4.22	1.66	1.33	2.64	1.78	1.74	2.28	1.41
2	1.94	2.72	1.65	3.28	1.33	1.07	2.08	1.42	1.38	1.79	1.14
3	2.83	4.07	2.40	4.93	1.91	1.51	3.06	2.04	2.00	2.66	1.60
4	1.54	2.20	1.31	2.66	1.05	0.83	1.66	1.12	1.09	1.44	0.88
5	0.64	0.92	0.54	1.12	0.42	0.33	0.69	0.45	0.45	0.60	0.35
6	0.16	0.24	0.14	0.29	0.11	0.08	0.18	0.12	0.12	0.16	0.09
7	0.14	0.20	0.11	0.24	0.09	0.07	0.15	0.10	0.10	0.13	0.08
8	0.47	0.70	0.39	0.85	0.31	0.24	0.51	0.33	0.33	0.45	0.25
9	0.34	0.49	0.28	0.60	0.22	0.18	0.37	0.24	0.24	0.32	0.19
10	0.36	0.51	0.30	0.62	0.24	0.19	0.38	0.26	0.25	0.33	0.20
11	0.10	0.15	0.09	0.18	0.07	0.06	0.11	0.08	0.07	0.10	0.06
12	0.16	0.23	0.13	0.28	0.11	0.08	0.17	0.11	0.11	0.15	0.09
13	0.28	0.40	0.23	0.48	0.18	0.15	0.30	0.20	0.19	0.26	0.16
14	0.46	0.70	0.38	0.86	0.29	0.22	0.51	0.32	0.32	0.44	0.23
15	0.76	1.14	0.64	1.38	0.50	0.38	0.83	0.54	0.53	0.73	0.40
16	2.45	3.55	2.06	4.31	1.64	1.29	2.66	1.75	1.72	2.31	1.36
Total	15.08	21.71	12.73	26.30	10.13	8.01	16.30	10.86	10.64	14.15	8.49



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